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# DEPARTMENT OF COMMERCE

## BUREAU OF STANDARDS

## WASHINGTON

BUREAU OF STANDARDS

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Technical News Bulletin No. 73.
May 8, 1923.

GENERAL NOTE

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

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1 The Sixteenth Annual Conference on Weights and Measures

The Sixteenth Annual Conference on Weights and Measures will be held at the Bureau of Standards on May 21 to 24 inclusive. Invitations have been sent out to all state, municipal, and other officials who are interested in weights and measures matters, and judging by the replies received, the conference will be unusually well attended.

A tentative list of papers which will be presented has been prepared and includes many extremely interesting subjects. The titles of some of these papers are as follows: "Fraudulent Practices and How We Eliminated Them," "The Attitude of the Mid-west Toward Abolition of Bushel Weights," "Temperature as a Factor in the Measurement of Gasoline," "Cooperation Between State and Local Officials," "Divergence in Bread Labeling Requirements," "Bread Weight Regulation from the Standpoint of the Retail Baker," "The Organization and Conduct of City and County Departments of Weights and Measures," "Problems Arising in the Supervision of Public Markets," "Origin and Destination Weighing of Coal in Carload Lots," "Retail Sales of Coal and Coke," "A Standard Test Method for Milk Bottles," "Results of the Bureau's Investigation of the Commercial Filling of Milk Bottles," "Commodity Tolerances," and "Sale of Service by Weight or Measure."

Among the reports of committees will be one on bread legislation and another on specifications and tolerances for vehicle tanks and fabric measuring machines.

The first morning of the conference will be devoted to the reports of delegates, while the second day will be "City and County Day," its sessions being devoted entirely to the problems of city and county weights and measures officials.

In connection with the conference, the usual exhibit of weighing and measuring appliances will be held in the Industrial Building of the Bureau, and it is expected that a large number of firms will avail themselves of this opportunity to set before weights and measures officials the latest improvements in their products.

2 Conference of State Purchasing Agents

On the day following the Sixteenth Annual Conference on Weights and Measures, that is, Friday, May 25, a conference will be held at the Bureau of Standards of purchasing agents from the various states. This is a subject in which the Secretary of Commerce is greatly interested, and it is expected that important steps leading to uniformity in state purchasing requirements will result from this meeting of representatives from almost every section of the country.

3 Annual Meetings of the American Physical Society and the Association of Scientific Apparatus Makers at the Bureau of Standards

The American Physical Society and the Association of Scientific Apparatus Makers of the United States held their regular annual meetings at the Bureau of Standards at Washington on April 20 and 21. In connection with the meeting of the Scientific Apparatus Makers, an interesting exhibit was arranged in the Industrial Building, and on Friday, April 20, a joint informal dinner of the two associations was held at the Hotel Ebbitt.

Among the papers presented at the sessions of the American Physical Society was one by H. D. Arnold and G. W. Elman on "Permalloy," a new alloy having valuable magnetic properties. It is composed of iron and nickel and was developed in the research laboratories of the American Telephone and Telegraph Company and the Western Electric Company.

The permeability of this new alloy, it was stated, is very much greater than that of the best magnet iron. It is being tried in a new submarine cable and is expected to increase the speed of sending with the cable about four times. It also has valuable uses in telephone and radio transformers and induction coils. In addition to its high permeability, it has a very small hysteresis loss.

The electrical resistance is found to vary with the strength of the magnetic field in which the alloy is placed, so that a difference amounting to three-tenths of a per cent is caused by the earth's magnetic field, the resistance being different in the east and west position from what it is in the north and south. Its electric and magnetic properties are also changed by the application of a load.

Among the other papers presented at this meeting was a description of a high-temperature high-vacuum furnace developed at the Westinghouse laboratories and used for tantalum and other metals which have high melting points and are very susceptible to oxidation at these high temperatures.

Dr. P. W. Bridgman of Harvard gave an account of some of his measurements of the thermal conductivity of liquids at high pressures. Dr. Bridgman's apparatus is capable of attaining pressures up to 20 000 atmospheres, or 300 000 lb. per sq. in. In the present paper the values of the conductivity were given at 6000 atmospheres and at 12 000 atmospheres. It was shown that the amount of heat conducted increases about 15% between these two pressures. The increase varies somewhat for the different liquids.

W. E. Forsythe of the Nela Research Laboratories described the results of comparisons of the standard high temperature scale in use at the Nela Laboratories with those used at the Bureau of Standards and at the National Physical Laboratory of England.

Other papers dealt with problems of acoustics, electricity, the determination of spectral lines, the quantum theory, and other problems of interest to physicists. A number of new and interesting types of apparatus were described. In all about 60 papers were presented.

Among the exhibits was an automatic daylight recorder which makes a record of the intensity and duration of the light throughout the day. It is possible to use color screens with this apparatus thus obtaining a record for light of any particular wave length.

A compound microscope, shown by another exhibitor, is designed so as to fold up and go in the pocket. When folded and placed in its case, it occupies about the same space and weighs about as much as a vest pocket kodak. Its magnifying power is as good as many of the smaller types of stationary compound microscopes.

A vacuum pump was shown which was conveniently arranged for lecture table use; and another, almost as compact, consisted of a combination of a rotary pump and a mercury vapor pump of the type used for producing the highest vacuua.

Another exhibit showed the various stages in the making of standard cells, and still others illustrated the latest developments in many types of instruments.

**4 Papers Presented Before the Meeting of the Sugar Division of the American Chemical Society**

The following papers were presented by members of the Bureau's staff at the New Haven meeting of the American Chemical Society held during the first week in April:

"A Possible System of Color Classification of Technical Sugar Products," by H. H. Peters and F. P. Phelps.

"The Absorption Spectrum of Panfeeds, Magmas, Run-Offs, and Granulated Sugars from Magmas," by H. H. Peters and F. P. Phelps.

"A Preliminary Note on the Color Problem of Soft Sugars," by H. H. Peters and F. P. Phelps.

"A Study of Basic Lead Clarification of Beet and Cane Molasses," by R. F. Jackson and R. S. Nowak.

At this meeting, the importance of more accurate ash determinations on sugars was brought out by the papers presented on that subject and resulted in the appointment of a committee to investigate this subject. A member of the staff of the Bureau of Standards is on this committee.

5 Fungicidal Effect of Ultra-Violet Light

In collaboration with the Bureau of Plant Industry, Office of Fruit Disease Investigation, the Bureau of Standards recently carried out an investigation of the fungicidal effect of ultra-violet light with special reference to the abiotic effect upon molds which affect oranges. Experiments were made upon affected fruit; also upon culture media containing fungi. The results obtained were of sufficient importance to warrant undertaking a problem which has been under consideration for some years, namely, a quantitative determination of the energy and wave length of the germicidal effect of ultra-violet rays.

6 Protection of Orange Trees Against Frost

There was mentioned some time ago in the Bulletin the work of the Bureau of Standards on the emissivity of roofing and tent materials, and it was pointed out that a decrease in the emissivity could be brought about by the application of aluminum paint. Recently the Weather Bureau requested the assistance of the Bureau of Standards in connection with increasing the effectiveness of a paper covering for protecting orange trees from frost. Paper, like cloth, has a high emissivity for infra-red rays. Hence, to prevent the rapid cooling of the tree, it appears that the paper hood should be covered with a coating of aluminum paint.

7 Radio Signals of Standard Frequency

Item 3 in Technical News Bulletin No. 71, issued on March 9, described the preliminary test and first regular transmission of radio signals of standard wave length. The results then secured were so satisfactory that it was decided to transmit standard frequency radio signals on 8 different evenings during May and the first part of June. The first of these transmissions took place on May 1 and 2 between 11:00 P.M. and 12:41 A.M., and future transmissions will be made in accordance with the schedule given in the table below.

As previously mentioned in the Bulletin, these standard frequency signals are to be used for standardizing wave meters and adjusting transmitting and receiving apparatus. The proper adjustment of such apparatus is particularly important in connection with the re-allocation of the waves as recommended by the Second Radio Conference held in Washington in March, 1923. Methods for receiving and utilizing these signals for wave meter calibration were described briefly in the February, 1923, issue of the Radio Service Bulletin which is published by the Bureau of Navigation of the Department of Commerce and can be obtained from the Superintendent of Documents.

More detailed information is given in Bureau of Standards Letter Circular 92, "Radio Signals of Standard Frequency and Their Utilization," which can be obtained upon application from the Bureau of Standards. The announced values of these signals are accurate to better than three-tenths of one per cent. It should be noted that the schedule given in the following table lists frequency in kilocycles and the wave length in meters, the latter being in parenthesis.

The time indicated in the following table from 11:00 to 11:56 is P.M., and from 12:00 to 12:41 is A.M.

Schedule of Transmission

| Eastern Standard Time | Signal | Kilocycles (Meters in Parenthesis) May 1 | May 7 | May 11 | May 17 | May 23 | May 29 | June 4 | June 11 |
|---|---|---|---|---|---|---|---|---|---|
| 11:00-11:04 | General Call | 400 | 400 | 900 | 200 | 75 | 1400 | 900 | 400 |
| 11:04-11:08 | Std.Frequency | (750) | (750) | (333) | (1499) | (3998) | (214) | (333) | (750) |
| 11:08-11:11 | Announcements | | | | | | | | |
| 11:15-11:19 | General Call | 500 | 500 | 1000 | 250 | 100 | 1500 | 1000 | 500 |
| 11:19-11:23 | Std.Frequency | (600) | (600) | (300) | (1199) | (2998) | (200) | (300) | (600) |
| 11:23-11:26 | Announcements | | | | | | | | |
| 11:30-11:34 | General Call | 600 | 600 | 1100 | 300 | 125 | 1600 | 1100 | 600 |
| 11:34-11:38 | Std.Frequency | (500) | (500) | (273) | (999) | (2399) | (187) | (273) | (500) |
| 11:38-11:41 | Announcements | | | | | | | | |
| 11:45-11:49 | General Call | 700 | 700 | 1200 | 350 | 150 | 1700 | 1200 | 700 |
| 11:49-11:53 | Std.Frequency | (428) | (428) | (250) | (857) | (1999) | (176) | (250) | (428) |
| 11:53-11:56 | Announcements | | | | | | | | |
| 12:00-12:04 | General Call | 800 | 800 | 1300 | 400 | 175 | 1800 | 1300 | 800 |
| 12:04-12:08 | Std.Frequency | (375) | (375) | (231) | (750) | (1714) | (167) | (231) | (375) |
| 12:08-12:11 | Announcements | | | | | | | | |
| 12:15-12:19 | General Call | 900 | 900 | 1400 | 450 | 200 | 1900 | 1400 | 900 |
| 12:19-12:23 | Std.Frequency | (333) | (333) | (214) | (666) | (1499) | (158) | (214) | (333) |
| 12:23-12:26 | Announcements | | | | | | | | |
| 12:30-12:34 | General Call | 1000 | 1000 | 1500 | 500 | 250 | 2000 | 1500 | 1000 |
| 12:34-12:38 | Std.Frequency | (300) | (300) | (200) | (600) | (1199) | (150) | (200) | (300) |
| 12:38-12.41 | Announcements | | | | | | | | |

3 Decimal Classification of Radio Subjects

In many organizations actively engaged in radio work, there is an urgent demand for a convenient and comprehensive method of classifying the large amount of printed matter and other radio material which is constantly accumulating. A good method of classification by subjects in which the grouping of like material together instead of simply in the order in which it was received results in the saving of a great deal of time and money. Knowledge to be of any value must be available for use. It is often easier to look up a fact anew than to search through a large amount of poorly classified material.

Several years ago the staff of the radio laboratory of the Bureau of Standards felt the need for a suitable classification in connection with its own work, and after some trials, it was decided that the decimal system of classification would be very useful for this purpose. A detailed decimal classification of radio subjects has, therefore, been prepared at the Bureau. Persons connected with library work are familiar with the Dewey decimal classification which assigns a classification number according to subject to every book in a library. The entire field of human knowledge is divided into nine main classes and each main class is subdivided as minutely as may be required.

The decimal classification adopted by the Bureau has been worked out so that it will fit conveniently into a library where the Dewey classification is already in use. In the Dewey classification, the number 621.384 represents radio communication, and the classification prepared at the Bureau of Standards is really a subdivision of this number. For the radio classification, the abbreviation "R" is suggested to represent the number 621.384.

Circular 138 of the Bureau of Standards, which has recently been issued, is entitled "Decimal Classification of Radio Subjects - An Extension of the Dewey System," and it can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10¢ a copy. In the classification given in this publication, the general field of radio communication is divided in nine main classes each of which may be subdivided as minutely as required. This system is used in classifying the references to current radio periodical literature which are published in each issue of the Radio Service Bulletin, and readers of this publication will find it worth while to purchase a copy of the classification since it will explain the significance of the numbers appearing before each reference in the monthly list. With a copy of the classification and a file of the Radio Service Bulletin, the literature on a given radio subject can be quickly located. The number of classes used by any organization will depend upon how detailed a classification it is desired to make. The system can be carried as far as it appears necessary.

9 Tests of Radio Receiving Sets

During the past two years, the Bureau of Standards has been developing methods for testing radio receiving sets, and has tested a number of different types. The results of this work are given in a series of letter circulars most of which are still in preparation.

The first of this series, designated as Letter Circular 90, "Tests of Radio Receiving Sets, I" has recently been issued. This circular describes tests of regenerative sets using electron tube detectors of the type intended for the reception of continuous wave signals from arc transmitting stations on wave frequencies down to 60 kilocycles, wave lengths up to 5000 meters.

Because of its interest in the reception of crop, market, and weather reports by radio, the Bureau of Agricultural Economics of the Department of Agriculture has assisted in this investigation. The particular receiving sets studied are referred to by arbitrary numbers rather than by the manufacturer's name or type and model numbers. It is believed that the methods followed and the examples given in this circular will be of assistance to manufacturers in the development of methods of testing and describing their own products and will, therefore, lead to their improvement. Some assistance will likewise be rendered to purchasers in the selection of apparatus.

A limited number of copies of these circulars are available and will be sent to those directly interested in this subject on application to the Bureau of Standards.

10 Thermal Stresses in Steel Car Wheels

Some of the work of the Bureau of Standards in testing car wheels has been described in previous numbers of the Bulletin. In 1920 a conference of several representative manufacturers and purchasers of steel car wheels was held at the Bureau to discuss plans for conducting an investigation of the thermal stresses developed in the plates of such wheels through heating of the rim during long brake applications. As experienced railway men stated that sometimes the tread becomes heated to a dull red, it was agreed that such an investigation would be of general interest and value to the steel wheel industry.

Eight worn 33-inch wheels were furnished by the Pennsylvania Railroad and nine new 33-inch wheels were furnished by several different manufacturers. One or more tests were also made on two special designs of wheels, the first with a thin plate, and the second with a straight plate. The wheels tested were representative of the five methods of manufacture in common use and were mounted in such a way that the axle was kept cool by running water while the tread could be heated by means of an electrical resistor close to but electrically insulated from the tread. Thermocouples were inserted at approximately 2-inch intervals to determine the temperature distribution,

while the radial stresses developed in the plate on both the face and back were indicated by means of strain gage measurements. The tensile properties and coefficient of expansion of the material from which the wheel was made were determined in auxiliary tests. The stresses were only calculated radially on the face and back of the plate since preliminary measurements indicated that the tangential stresses were of a compressive nature and of small magnitude.

Ordinarily the tread of the wheel was heated to a temperature of about 380°C, but in the case of two new rolled wheels and one cast wheel, the treads were heated to the highest temperature attainable with the equipment, about 500°C. Considerably more time was required to reach this temperature than to reach the temperature of 380°C, but the stresses were no greater. The greater strain appeared to be offset by the greater expansion resulting from the higher temperature, thus giving a flat stress time curve between 380 to 500°C.

The most interesting features revealed in these tests may be summarized as follows:

(1) None of the wheels failed.

(2) When the rim is heated, the hub moves with respect to the rim inducing stresses in the plate. For the first test on new wheels these are in tension near the hub and in compression near the rim on the face, while on the back of the plate, the stresses for the same locations near the hub and rim are about equal in magnitude but of opposite sign.

(3) For worn wheels, the stresses are of the same character except near the rim on the face where very little stress is found. This difference is due to shifting of the neutral axis on the face brought about by conditions of service.

(4) The maximum stresses are on the surface and slightly above the yield point of the material which averages about 50 000 lb. per sq. in. as determined in tensile tests.

(5) A permanent set resulted only in the case of new wheels on the first test. For worn wheels and in succeeding tests on new wheels, no set was apparent, showing that stresses above the yield point were not increased by repeated heating and that through the effects of service the old wheels had been brought to a condition approximating that of the new wheels after the first heating.

(6) For all forged wheels, the character and magnitude of the stresses are but little affected by the method of manufacture. Because of the corrugated plate, the stresses developed in the cast wheels were more complicated than those in the forged wheels.

(7) The special rolled wheel with the thinner plate 1/2 inch thick developed stresses similar to those in the wheels of regular design but of somewhat greater magnitude, while the stresses produced in the special straight plate wheel were in pure tension on both the face and back of the wheels.

This work is described in detail in Technologic Paper No. 235 of the Bureau of Standards which will be available at an early date from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15¢ a copy.

11 Lathe Breakdown Tests of Some Modern High-Speed Tool Steels

Technologic Paper No. 236 of the Bureau of Standards, which can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15¢ a copy, is concerned with comparisons of performance of modern high-speed tool steels in "lathe breakdown tests."

The work described in this report dealt not only with tests in which the endurance of tools is measured under definite working conditions, but likewise with the limitations of this method of testing when applied to the purchase of steel. The modern steels are first classified according to chemical composition, and this division is made use of in discussing the results obtained.

Important features developed may be summarized as follows:

(1) Breakdown tests are not satisfactory as the basis of purchase for tool steels.

(2) While competitive comparisons of brands of nearly similar performance are not justified, owing to the qualitative nature of this type of test, relatively large differences may be ascertained with certainty, provided sufficient tools are tested and averages of at least two grinds are used in interpreting the results.

(3) In certain severe breakdown tests with roughing tools on 3% nickel steel forgings in which high frictional temperatures were developed, it was found that the performance of commercial low tungsten-high vanadium and cobalt steels was superior to that of the high tungsten-low vanadium type, as well as special steels containing about 1/4 per cent uranium or 3/4 per cent molybdenum. The average power consumption in all cases was practically the same so that this factor need not be introduced in comparisons which may be made on the basis of the endurance of the tools.

(4) Modification of test conditions, including small changes in tool angles but principally changes in the cutting speed more markedly affected the performance of steels containing cobalt or special elements, such as uranium or molybdenum, than the basic types, such as plain chromium-tungsten-vanadium steels.

(5) The relatively poor endurance of high tungsten steels under severe working conditions was not observed in more moderate tests which were made on the same test log with equal cutting speed and depth of cut, but with reduced speed and in which the frictional temperatures produced were not so high. Also, in those latter tests the performance of the cobalt steels was better than either the low or high-tungsten steels.

(6) Hardness determinations and examination of fractures indicate that the various types of commercial high speed steel show differences in behavior under heat treatment and in physical properties which probably are of importance under moderate working conditions and might counterbalance slight advantages in performance.

12 Scratch Hardness of Copper

The Bureau of Standards is conducting an investigation of the instrument used for the determination of the scratch hardness of metals, and in connection with this work, considerable attention was paid during the past month to the effect of various amounts of cold working on the hardness of copper. The results obtained in cold rolling very pure, electrolytic, unmelted copper and also ordinary commercial copper indicate clearly that the early stages of the deformation of the metal harden it very rapidly. The maximum degree of hardness is soon reached, however, and a reversal occurs, the metal becoming very appreciably softer as the deformation process is continued, so that the metal in its final condition after cold rolling is completed, is softer as measured by the scratch hardness method than in its initial state. These results were confirmed by tests made on the same material by the micro-Brinell method. Annealing cold rolled sheets at a low temperature (100°C) softens the material appreciably, but the general form of the hardness deformation curve is not affected. The work will be extended to a few other metals to determine whether this behavior is peculiar to copper or more general in its nature.

13 Study of Quenching Media

The object of a new investigation started by the Bureau during the past month is to obtain more complete information than is now available on the cooling properties of the ordinary quenching liquids used in the heat treatment of steel. It is also hoped that some information bearing on the subject of dimensional changes, occurring during the hardening of steel, will also be obtained. The preliminary work has been devoted largely to setting up the necessary apparatus, but a few preliminary experiments have been carried out on quenching nickel cylinders in water with very satisfactory results. As the preliminary work is now practically completed, it is hoped that considerable progress will be made on the main investigation during the next few weeks.

14 New Standard Steel Sample

The distribution, with a provisional certificate, of Standard Sample No. 11c Basic Open Hearth 0.2% Carbon Steel, was commenced during the past month.

15 Some Tests of Steel Wire Rope on Sheaves

Technologic Paper No. 229 of the Bureau of Standards, for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10¢ a copy, describes tests of wire rope on sheaves. The object of this work was to determine the strength of 5/8, 3/4, 7/8, 1, 1 1/4-inch wire rope under static load. All the rope was of 6-strand, 19-wire construction, made from plough steel. It was found that the strength was less than that of straight rope having socketed ends. Considering the strength of the straight rope as unity, the strength of 5/8-inch rope on 10-inch sheaves was 87.4% and on 18-inch sheaves 95.3%, while 1 1/4-inch rope had a strength of 75.8% on 10-inch sheaves, and 84.7% on 18-inch sheaves. The other sizes had corresponding values.

Tensile tests of wires from the ropes showed that the wires had the high strength of 230 000 lb. per sq. in., and an elongation of 2% with a reduction of area of about 46%. The strength was practically the same for all series of the wires.

The strength of the straight ropes followed closely the equation $S = 83\,000\ d^2$ in which S is the strength in pounds and d is the diameter of the rope in inches.

One worn rope which was tested showed a surprisingly high strength when its condition is considered.

A point of inflection in the load diagrams was found at from 56 to 65% of the ultimate load above which the elongations increased rapidly.

A wire rope under tensile load undergoes considerable elongation and reduction of diameter. The total elongation near the ultimate was about 2.5% after repeated loads.

The modulus of elasticity of steel wire rope may be assumed to be about 8 500 000 lb. per sq. in. for new rope loaded a number of times to one-fifth its ultimate strength.

Some conclusions are drawn upon the effect of heavy loads in squeezing lubricant out of the core of the rope and the wear which follows.

16 The Strength of Corrugated Roofing

In cooperation with the American Zinc Institute, the Bureau is carrying on an investigation to determine the safe load which can be placed on zinc roofing for a given spacing of the purlins. This information is greatly needed not only by builders but by manufacturers of corrugated zinc roofing. It is generally believed that reliable values for the safe loads to which roofing of this type can be subjected are not available. The qestion of the proper use of this material is of great economic importance and as zinc is used very successfully in Europe, it would seem that it ought to find a place in the roofing materials employed in this country.

17 Behavior of Stone Under Continued Loading

A series of tests has been started by the Bureau of Standards to determine whether stone breaks or permanently deforms under continuous stress which is considerably less than the breaking stress. In structures we frequently see broken lintels or other members which are entirely under compression and where the load could not be near the theoretical breaking load. This would seem to indicate that stones break because of fatigue at a much lower stress than those obtained when a test is made. In the tests now under way, a series of beams is being loaded to approximately two-thirds of the breaking load and kept under this stress continuously for a long period. Deflection measurements will be made from time to time to determine whether there is a continuous sagging and if there is a permanent deformation due to the load.

18 Bond of Mortar Joints Between Stones

Bond tests are in progress to determine the strength of joints between stone and various mortars. It is expected that this series of tests will be extended later to determine the effect of various treatments on the strength of the bond, such as, for instance, waterproofing the backs and sides of the stone with pitch or colorless waterproofing materials.

19 Service Tests of China Tableware

The Bureau of Standards has arranged for a series of service tests of hotel china at several prominent hotels. The tests have already been started at the Biltmore Hotel in New York and will be commenced at other places in the near future. Samples of the plates tested will be sent to the Bureau for laboratory examination, and large lots of the same ware will be put in service and examined from time to time in order to correlate the service given by the plates with the laboratory results.

20 Meeting of the Committee of the Federal Specifications Board on China and Glassware

The Federal Specifications Board's committee on china and glassware, at a meeting on March 26, adopted a list of sizes and shapes of chinaware and glassware which was accepted by all members of the committee. The resulting list shows a very considerable cut in the variety of sizes and shapes besides being definite and simple, and it will be used in obtaining bids. Drawings of all these articles have already been made and exhibited to all members of the Potters' Association so as to make certain that the articles adopted as standard are made by practically all manufacturers of this type of ware. It so happens that the potters are arranging a standard list of hotel ware in which only those articles are enumerated which are made by all potters for hotel and railroad service. The list adopted by the committee is similar to the list which the potters expect to adopt with very few exceptions.

A meeting will be held next month of potters, hotel buyers, representatives of the Pullman Company, and the Federal Specifications Board for the purpose of agreeing upon a final list.

21 Coefficient of Expansion of Glass Pots

The relation between the coefficient of expansion of the material from which the glass pots are made and that of the glass is an important matter, since it influences the cracking of either the pots or glass or both during cooling. During the month, the Bureau of Standards has measured the coefficient of expansion of three pieces of glass pot bodies, two being of the same composition but cooled in different ways while the third was of another composition. The values show a uniform increase from 0° to 700°C (the limit of the test) of about 0.04 micron per cm per degree Centigrade which is much less than the corresponding value for borosilicate glass, this value being 0.1 micron. Therefore, the only explanation for the tendency of borosilicate glass to break in pots, even with slow cooling, is that the relative strength of the glass is less than that of the pot.

22 Tables of Thermodynamic Properties of Ammonia

Item 1 in Technical News Bulletin No. 62 described the practical completion of the work which the Bureau has been conducting for several years on the thermodynamic properties of ammonia. As mentioned in that item, this work was undertaken at the request of the refrigeration industry and was carried out during the periods 1915-17 and 1920-22.

Ammonia of a very high degree of purity was prepared and used in the measurements of its physical properties. The more important properties determined were the specific heat of the liquid, the latent heat of vaporization, the vapor pressure and the specific volume and specific heat of the superheated vapor. The results of the investigation are included in a series of 12 Scientific Papers, some of which have already been published.

The tables of thermodynamic properties thus embody results of actual measurements made upon ammonia of known purity in a single laboratory, in a program of individual investigations each complete in itself, each planned and executed according to a high standard of accuracy, and all extending over or beyond the range of conditions to be encountered in practice. The completion of this work probably gives to ammonia the distinction of being better known as to its thermodynamic properties within its working range than any other substance.

Preliminary tables embodying the results, as far as the work was completed, have been issued to meet the requirements of refrigerating engineers for such data in connection with design, testing, and operation of refrigerating machinery. However, it is only within the past month that these tables have been collected into one pamphlet which includes the results of all the work in convenient and readily obtainable form.

This pamphlet is Circular No. 142 of the Bureau of Standards, and it can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 15¢ a copy.

PUBLICATIONS OF THE BUREAU OF STANDARDS RELEASED DURING APRIL.

Scientific Papers

| | | |
|---|---|---|
| S 465 | Composition, purification, and certain constants of ammonia. E. C. McKelvey and C. S. Taylor | 10¢ |
| S 466 | Wave length measurements in the arc spectra of gadolinium and dysprosium. C. C. Keiss | 5¢ |
| S 467 | Specific volume of saturated ammonia vapor. C. S. Cragoe, E. C. McKelvy, and G. F. O'Connor | 5¢ |

Technologic Papers

| | | |
|---|---|---|
| T 229 | Some tests of steel-wire rope on sheaves. E. Skillman | 10¢ |
| T 230 | A recording chronograph for the inverse rate method of thermal analysis. H. J. French | 5¢ |
| T 231 | Tentative standard test methods and percentages of oil and moisture in hair press cloths. F.R.McGowan and C. W. Schoffstall | 5¢ |
| T 232 | Shellac. P. H. Walker and L. L. Steele | 5¢ |
| T 234 | Methods of measuring the plasticity of clays. E.P.Hall | 10¢ |

Circulars

| | | |
|---|---|---|
| C 24 | Supplement of January 31, 1923. | |
| C 78 | Solders for aluminum (2nd edition) | 5¢ |
| C 137 | Auxiliary condensers and loading coil used with simple homemade radio receiving outfits | 10¢ |
| C 138 | A decimal classification of radio subjects - An extension of the Dewey system | 10¢ |
| C 140 | U. S. government specification for wood screws | 5¢ |

These publications may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices given above.

Respectfully,

George K. Burgess

Director
HGB